Section 10 Contents

10 SECTION Agricultural Water

UTAH STATE WATER PLAN - WEBER RIVER BASIN PLAN

The Weber River Basin is known for its highly productive farms and development of irrigated agriculture. Historically, agriculture has been the single largest use of water in the Weber River Basin. With the current rate of urban development, agricultural water is now being converted to other domestic and commercial uses.

10.1 Introduction

This section evaluates the overall status and various aspects of agricultural water use within the Weber River Basin. Specific topics include 1) current and projected agricultural land use and cropping practices, 2) irrigation water requirements, 3) water conservation from on-farm irrigation practices and off-farm water conveyance systems, and 4) drainage of excessive groundwater from irrigated crop lands.

10.2 Background

The sustained growth of irrigated agriculture made the construction of major water reclamation projects feasible. Completion of the Ogden River, Weber River and Weber Basin projects has increased the diversions for irrigated agriculture from a few thousand acre-feet to 472,700 acre-feet in 1987.

Historically, the development of water has been synonymous with the growth and development of small farming communities. The first major diversions for irrigated agriculture were made immediately upon the arrival of the first pioneers in the basin during the late 1800s. The first diversions of water from the Weber and Ogden rivers were made to small family farms to produce a food supply for the winter months and to begin a local agricultural based economy.

Although the early settlers enjoyed an abundance of water for all domestic uses, the rapid demand for irrigation water soon out-grew the annual supplies. It became apparent that large water storage structures were necessary to capture early season runoff from the high mountain watersheds for late season irrigation use. To fill this need, an era of large reclamation project construction resulted in the completion of the Weber River, Ogden River, and Weber Basin projects. These projects constructed seven major reservoirs with a combined active storage capacity of 518,300 acre-feet; thousands of miles of canals, aqueducts and ditches; three major culinary water treatment plants; and a number of flood control improvements.

More recently, the Smith and Morehouse Reservoir was reconstructed and enlarged to an active storage capacity of 7,600 acre-feet.

10.3 Agricultural Lands

Factors that influence the use of water for irrigated cropland include soil characteristics, climate and crop water requirements. Soil characteristics determine water storage within root zones while the type of crop determines water use. Climate defines the potential for water consumption. Irrigated agricultural lands include a broad range of soil conditions, climates and a variety of cropping practices. As a result, the demand for irrigation water varies significantly.

10.3.1 Soil and Climate Characteristics

The basin is divided into three general agricultural areas primarily defined by climate, soil conditions, and physical-hydrological conditions. These subareas and irrigated cropland are shown on Figure 10-1. The lower drainage includes the East Shore Area while the upper drainage includes the upper reaches of the Weber and Ogden rivers east of the Wasatch Range.

Upper Weber River Drainage - The upper drainage of the Weber River generally includes all of Morgan and Summit counties within the hydrological boundaries of the Weber River Basin. The area is characterized as high mountain valleys with elevations ranging from 4,900 to 11,500 feet above mean sea level. Agriculture in the area is limited, primarily due to short growing seasons and the existence of soils with moderate to poor tillage characteristics to support common row and forage crops. Water quality for agricultural purposes is good to excellent. The growing season generally starts in June and runs to early September with an average of about 90 frost free days per year.

Generally, the soils found in the upper basin are capable of supporting irrigated agriculture. The lands include alluvial fan soils, alluvial river bottom soils and old river terrace or bench land soils. Soil deficiencies generally include excessively rocky profiles, limited water holding capacities, rolling topography, slopes ranging from 4 percent to 10 percent, and clay lenses that limit vertical drainage.

Salinity and alkalinity are not a problem. Water and soil samples taken during the initial planning phases of the Weber Basin Project indicate the average soluble salt contents were well under 10 percent and soil pH readings were below the 8.4 level.

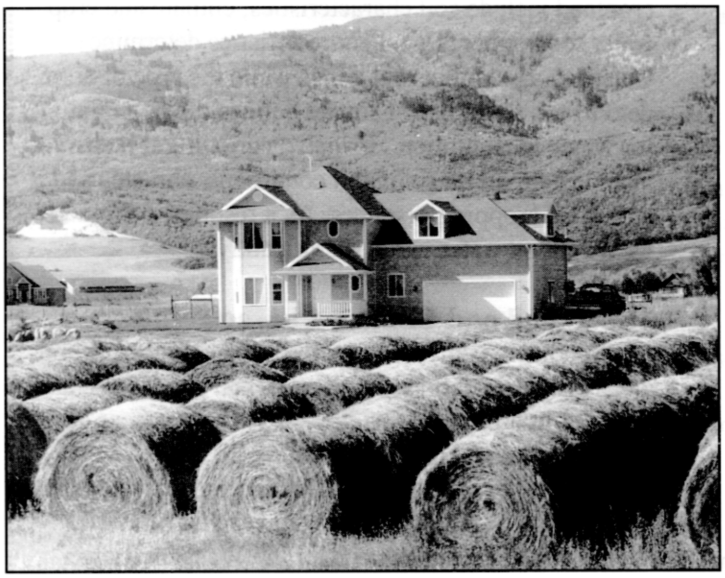
Ogden Valley - Ogden Valley has the same climatological features as the upper Weber River Basin with elevations ranging between 4,900 to 9,700 feet above mean sea level. Agriculture is limited by a short growing season and soil conditions. Water quality for agricultural purposes is considered good to excellent with no limitations regarding salinity or excessive heavy metals concentrations. The growing season in Ogden Valley runs from about June through September, with about 90 frost free days.

The valley has approximately 8,900 acres of irrigated land. Of this total, roughly 7,000 acres have optimal conditions for irrigated agriculture. The soils currently under irrigation have moderate to steep slopes ranging from 1 percent to 10 percent. They are predominantly heavy loams with relatively high water holding capacities and good drainage. After 100 years of irrigated agriculture, Ogden Valley has not been hampered by excessive soil alkalinity or salinity.

East Shore Area -The East Shore Area includes that portion of Weber and Davis counties west of the Wasatch Front and east of the shores of the Great Salt Lake. It is the largest of the agricultural subareas with elevations ranging from 4,200 to 9,700 feet above mean sea level.

The climate within the East Shore Area allows for an extended growing season ranging from 120 to 200 days with an annual average temperature of 50.7°F. Although some areas have moderate to severe drainage problems, a relatively large percentage of the area has exceptional agricultural soils.

In general, extensive clay lenses exist at locations where ancient lake levels were high and excessive water depths allowed for the gradual deposition of heavy clay material. These areas are primarily found within the limits of the Great Salt Lake and extend several miles toward the Wasatch Range.



Near Eden

As ancient Lake Bonneville lowered, flow from existing canyons deposited layers of silt, sand and clay in the flood plains of the Ogden and Weber rivers. The soils currently under irrigation in the East Shore Area are generally mixtures of sandy-silt loams with various mixtures of clay. These soils have excellent tillage characteristics with exceptional water holding capacities. In areas adjacent to the Great Salt Lake, however, the soils consist mainly of clay material and exhibit poor drainage characteristics. As a result, the western portions have moderate to severe salinity problems limiting the practice of irrigated agriculture.

10.3.2 Irrigated Cropland

Most crops such as alfalfa, corn, small grains, potatoes and a variety of vegetables are grown. These crops account for approximately 40 percent of the total irrigated acreage. Various types of pasture grasses account for the remaining irrigated acreage. Orchards account for less than 1 percent of the total irrigated acreage and are generally located on valley benches. Pastures are found throughout the basin including areas with poorly drained soils. A summary of irrigated land by crop type is given in Table 10-1.

It has been estimated that more than 70 percent of all the irrigable land is flood irrigated with furrow and border application methods the most common. Furrow irrigation is used for the production of row crops such as grain or silage corn, potatoes and most vegetable crops. Border irrigation usually applies to the irrigation of alfalfa, pasture grasses and various forage crops. Flood irrigation efficiencies range from a low of near 40 percent to a maximum of over 70 percent for well-designed and operated level borders.

Sprinkler irrigation systems commonly used are either hand-move, solid set or wheel-line systems. Center pivot systems are normally utilized on large farms of 160 acres in size. Most farms and ranches are substantially under the 160-acre limit for the feasible operation of center pivots. Sprinkler irrigation efficiencies range from a low of 50 percent to a high of 70 percent when operated correctly and according to localized evapotranspiration data. Irrigation diversions, depletions and per acre diversions, and evapotranspiration for the major agricultural areas for 1987 are summarized in Table 10-2.

10.3.3 Dry Cropland

A small percentage of the agricultural lands are dry farms or dry cropland. Most of the agricultural lands that do not receive irrigation water are above existing canals and ditch systems. The dry farms that do exist are located in the upper Weber and Ogden rivers and normally grow small grains, pasture and alfalfa. The Division of Water Resources has estimated the acreage of dry land crops near existing irrigated lands including 500 acres of small grains, beans, and seed crops; 1,200 acres of alfalfa; 2,600 acres of pasture; and 100 acres of fallow lands in their dry land classification.

10.3.4 Range and Forest Land

The Wasatch-Cache National Forest, managed by the U.S. Forest Service, covers part of the Weber River Basin. It includes several boating and camping facilities at Pineview Reservoir and a campground at Smith and Morehouse Reservoir. Forest Service responsibilities include the overall management of all watersheds within the national forest boundaries. Of primary importance is the prevention of soil erosion caused by excessive flood runoff, protection of existing natural resources such as timber and wildlife habitat, livestock grazing management, and development and maintenance of adequate outdoor recreational facilities.

10.4 Agricultural Water Problems and Needs

Water historically used for irrigated agriculture is gradually being transferred to municipal and industrial uses. Conversion of agricultural water is effectively offsetting the need to develop new sources of water for M&I uses. Agricultural water is being converted primarily to M&I secondary water to service residential and commercial developments constructed on irrigated farms and ranches.

10.4.1 Cropland Conversion

The amount of irrigated cropland has declined in recent years as land has been converted to residential and commercial developments. Water-related land use mapping in 1968 and 1987 shows a decline of 21,700 acres during this 19 year period. If this decline continues, less than 100,000 acres of irrigated cropland will remain by the year 2020. Table 10-3 shows current and projected irrigated cropland by county.

10.4.2 Irrigation Water Conservation in Ogden Valley

Like other areas of the basin, the Ogden Valley was initially settled by farmers and ranchers who utilized flood irrigation practices to apply water to small family farms and ranches. The valley's source of irrigation water is generally from the upper drainages of the Ogden River. Initially, water was diverted from the north, south and middle forks of the Ogden River by a system of small canals and ditches. With the completion of the Weber Basin Project, a major diversion structure for irrigated agriculture was constructed on the South Fork of the Ogden River. The diversion provides up to 80 cfs of water for irrigated agriculture throughout the valley.

Although the addition of the South Fork diversion and canal provided additional water for irrigation, Ogden Valley farmers and ranchers still experience periods of water shortages during exceptionally hot irrigation seasons with less than average precipitation.

A need exists for the conversion from traditional flood to sprinkler irrigation practices. Conversion would

Figure 10-1
IRRIGATED AGRICULTURAL AREAS

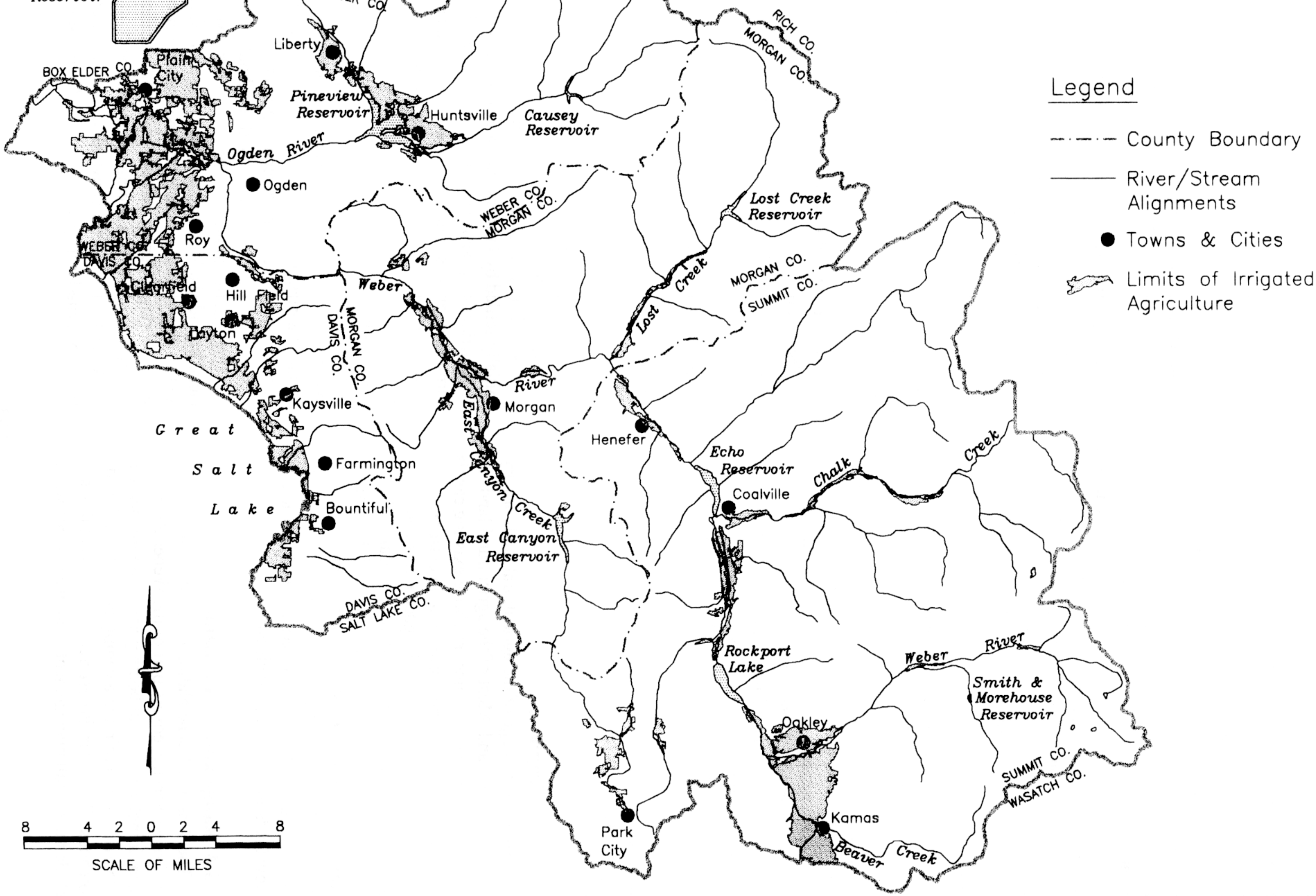


Table 10-1
IRRIGATED LAND BY CROPS AND COUNTY (1987) [a]

Crop	Davis	Weber	County Morgan (acres)	Summit	Total
Fruit	383	440	1	2	826
Other Hort.	39	0	0	0	39
Grain	4,603	5,826	1,862	844	13,135
Corn	5,157	6,277	757	0	12,191
Vegetables	2,157	387	6	0	2,707
Potatoes	2,314	23	0	0	196
Onions	173	85	0	0	344
Beans	259	272	0	0	272
Other Row	0	24	0	0	24
Alfalfa	0	12,515	4,594	4,540	28,330
Grass Hay	6,681	2,523	1,154	9,589	14,354
Grass/Turf	1,088	32	34	298	548
Pasture	184	15,653	2,285	12,904	39,598
Subirrigate	8,756	17,860	707	957	26,066
Total	6,542	61,917	11,400	29,134	138,630

Source: Division of Water Resources Land Use Inventory.
a Does not include idle and fallow land.

Table 10-2
IRRIGATION DIVERSIONS AND DEPLETIONS (1987)

Consumptive Use	Upper Weber	Ogden Valley	East Shore	Totals Averages
Crop Diversion (CD in acre-feet)	132,100	28,800	311,800	472,700
Net Depletions (ND in acre-feet)	50,400	12,600	161,500	224,500
Total Irrigated Acreages (TIA in acres)	37,600	8,900	92,100	138,600
CD/TIA (acre-feet/acre)	3.5	3.2	3.4	3.4
ND/TIA (acre-feet/acre)	1.3	1.4	1.8	1.6
Gross Irrigation Efficiency (percent)	38.2	43.8	51.8	47.5

County	1987	1995	2000 (acres)	2010	2020
Davis	37,800	32,700	29,400	22,900	15,000
Weber	63,100	60,700	58,500	53,400	47,600
Morgan	11,800	11,700	11,600	11,400	11,200
Summit	29,400	28,500	27,800	26,400	23,700
Basin Total	142,100	133,600	127,300	114,100	98,500

Table 10-3
CURRENT AND PROJECTED IRRIGATED CROPLAND CHANGES[a]

a Includes idle and fallow lands.

promote water conservation during periods of water shortages. Other benefits would include the lowering of high water tables in some critical areas of the valley with relatively high densities of domestic septic tanks and drain fields, a reduction in surface runoff to lower subdrainages including Pineview Reservoir, and an increased availability of water for other domestic uses.

10.5 Conservation and Development Alternatives

Estimates of water loss in most open channel water conveyance systems range from 10 to 50 percent. Typical water losses from pipelines are less than 10 percent. With current (1992) agricultural diversions of 446,400 acre-feet, considerable water can be conserved through the implementation of conservation measures.

The best and most effective means of conserving water in any conveyance system is replacement of existing canals and ditches with pipelines. Another means of conserving water in open channels is to line interior surfaces with impermeable materials including concrete, synthetic membranes and various clay materials with low permeabilities.

The decision to install pipe or line an open channel is usually based on economics, although non-economic factors should also be considered. Non-economic considerations include the effect of seepage on groundwater quality, potential use of land over piped conveyance facilities and safety issues.

Water is applied to cropland by either flood or sprinkler irrigation methods. Of the two methods, flood irrigation is the most widespread. Factors favoring flood irrigation include the relatively high equipment and operational costs to install more efficient irrigation systems and the general compatibility of existing soils and topography to flood irrigation practices. Even though flood irrigation has worked well for over 140 years, some water saving can be realized by converting to sprinkler irrigation.

10.6 Agricultural Drainage

Although the main objective of most water projects is the development of additional water supplies, occasionally the situation is reversed. High water tables must be lowered in agricultural lands to make lands productive for normal cropping practices.

As part of the initial Weber Basin Project, a number of investigations were conducted by the Bureau of Reclamation to identify areas with high groundwater conditions that would adversely affect projected cropping practices. These investigations identified considerable acreage of agricultural land with existing and potential high groundwater levels, mostly in the East Shore Area.

Taking into consideration a number of factors including land use, optimum soil conditions for agricultural cropping practices, soil drainage potential, length of growing season, farming economics and ability to repay projected construction costs, the Bureau of Reclamation identified 37,200 acres of farmland in the East Shore Area to be drained over a period of roughly 50 years. Drainage would allow continuation of irrigated agriculture in the area and the eventual partial repayment of construction costs by increased annual assessments.

The extent of the bureau's initial drainage system included 65 miles of buried drains and 117 miles of open drains that would potentially discharge into the Great Salt Lake and/or surrounding wetlands. Because of the gradual decline of irrigated agriculture, only 35 miles of buried and open drains were actually constructed.

Future plans for drainage of irrigated agricultural land have, for all intents and purposes, been abandoned. Current federal environmental regulations requiring the preservation of wetlands and the general decline of agriculture have made drainage projects impractical and infeasible. ❖